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REMARKS

Pending Claims

Claims 1-44 are pending in the present application. Claims 1, 20, and 44 have been amended. The Applicant respectfully requests reconsideration of the pending claims in light of the amendments and arguments presented in this Supplemental Amendment and Response.

Response to Examiner's Interview Summary

The Applicant's Attorney wishes to thank Examiners Blevins and Healy for their time interviewing this case on December 21, 2005. The Applicants are submitting the present Supplemental Amendment and Response in light of the Interview Summary mailed December 28, 2005. Claims 1, 20 and 44 have been amended to further clarify that the optical signal launched into the multi-mode optical fiber has a plurality of modes. The Applicants are willing to submit affidavit evidence to support factual statements if necessary.

The Examiner's Interview Summary states that the claimed invention is not differentiated from the prior art because the multi-mode optical fiber of the prior art is capable of transmitting a plurality of modes. Shoval describes the multi-mode optical fiber as a transmission high-order mode fiber 128 that has a relatively large effective area that is optimized to propagate a desired single higher order spatial mode, such as the LP₀₂ spatial mode. See Shoval Column 9, lines 45-50. Nevertheless, the Applicants agree that the transmission high-order mode fiber in Shoval is capable of transmitting a plurality of modes under some conditions if configured in a system that is not described in Shoval.

However, the Applicants do not agree with the conclusion that the claimed invention is not differentiated from the prior art because the multi-mode optical fiber of the prior art is capable of transmitting a plurality of modes. Shoval describes a high-order spatial mode transmission system that is specifically designed to not transmit optical signals comprising a plurality of modes. The fact that the transmission high-order mode fiber 128 described in the Shoval patent can transmit a plurality of optical modes in some hypothetical configuration,

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which is not described in Shoval, is not a valid basis for rejected the claims as currently amended under 35 U.S.C. §102.

To anticipate a claim under 35 U.S.C. §102, a single reference must teach every aspect of the claimed invention either explicitly or impliedly. Shoval does not teach every aspect of independent claim 1 as currently amended for at least the reason that Shoval does not describe a spatial mode converter that converts the optical signal to a plurality of modes and conditions a modal profile of the optical signal for propagation through a multi-mode optical fiber. Instead, Shoval describes a system that includes a spatial mode converter that is specifically designed to transmit only a single higher order spatial mode and to not transmit a plurality of optical modes. Specifically, Shoval states in Column 9, lines 33-35 that the high-order spatial mode transmission system includes a spatial mode transformer 126 that "converts substantially all of the light to a single higher order spatial mode," such as the LP_{02} spatial mode.

The fact that Shoval states that "substantially all" of the light is converted to a single higher order spatial mode does not indicate that the Shoval high-order spatial mode transmission system includes a spatial mode converter, which converts the optical signal to a plurality of modes as claimed in the presently amended claims. In addition, the fact that Shoval states that "substantially all" of the light is converted to a single higher order spatial mode does not suggest that the Shoval high-order spatial mode transmission system purposefully converts any of the optical signal to a plurality of modes as claimed in the presently amended claims. In fact, the Applicants believe that if the Shoval spatial mode transformer 126 did convert a portion of the optical signal to a plurality of modes as claimed in the presently amended claims, that portion of the optical signal including the additional modes would be lost in the transmission system and would not be received by a receiver 114.

The Applicant's conclusion that the additional modes would be lost in the transmission system and not received by the receiver 114 is supported in Shoval Column 9, lines 57-66. Shoval states that the second spatial mode transformer 130 converts substantially all signals from a single higher order mode, such as the LP_{02} spatial mode, back to the fundamental LP_{01} spatial mode for transmission in the single mode optical fiber 112. Other modes, such as the LP_{01} spatial mode, are converted to higher order spatial modes. The single mode optical fiber

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attached to the second spatial mode transformer 130 is specifically designed to support only the LP_{01} spatial mode and to prevent other modes from propagating. Therefore, modes other than the single higher order mode generated by the spatial mode transformer 126 will not be transmitted in the single mode optical fiber 112 and thus, will not be received by the receiver.

Therefore, the Applicants submit that Shoval does not teach every aspect of the claimed invention either explicitly or impliedly because Shoval does not teach the claimed spatial mode converter and, in fact, teaches performing a different function of converting the optical signal to a single high-order optical mode. Thus, the Applicants submit that independent claim 1 is not anticipated by Shoval.

The fact that the transmission high-order mode fiber 128 described in Shoval can transmit a plurality of optical modes in some hypothetical configuration, which is not described in Shoval, is also not a valid basis for rejecting the pending claims as obvious over Shoval. The second spatial mode transformer 130 in Shoval would need to be modified in order to transmit modes other than the single higher order mode, which is generated by the spatial mode transformer 126, through the transmission high-order mode optical fiber 128 to the receiver 114. Such a modification would require a spatial mode transformer 130 that operates differently from the spatial mode transformer 130 described in Shoval so that modes other than the LP_{01} spatial mode propagate through the single mode optical fiber 112 to the receiver 114. Such a modification will also increase the noise received by the receiver 114, which defeats the purpose of the noise reduction methods described in Shoval. In addition, the transmission high-order mode fiber 128 in the embodiment described in Column 9 of the Shoval may also need to be modified since the fiber described has a relatively large effective area that is optimized to propagate the desired single higher order spatial mode, such as the LP_{02} spatial mode.

Thus, in order to transmit modes other than the single higher order mode described in Shoval through the Shoval high-order spatial mode transmission system to a receiver, the transmission system would need to be modified. Such a modification would change the principle of operation of the Shoval transmission system. According to M.P.E.P. § 2143.01 claim 1 can not be prima facie obvious over Shoval because the principle of operating the Shoval transmission system would change if the system were modified to transmit a plurality of modes.

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For these reasons and the reasons stated in the Amendment and Response mailed on December 9, 2005 the Applicant submits that independent claim 1 is allowable over the prior art of record and that dependent claims 2-19 are allowable as depending from an allowable base claim.

Similarly, Shoval does not teach every aspect of independent claim 20 as currently amended for at least the reason that Shoval does not describe a method that includes the step of spatial mode converting an optical signal to a plurality of modes to reduce modal dispersion and to increase an effective bandwidth of an optical signal launched in a multi-mode optical fiber. In addition, Shoval does not teach every aspect of independent claim 28 as previously amended for at least the reason that Shoval does not describe a spatial mode converter that converts the optical signal to a plurality of modes and that conditions a modal profile of the optical signal for propagation through a multi-mode optical fiber. Furthermore, Shoval does not teach every aspect of independent claim 44 as currently amended for at least the reason that Shoval does not describe a means for spatial mode converting an optical signal to a plurality of modes to reduce modal dispersion and to increase an effective bandwidth of an optical signal launched into a multi-mode optical fiber.

For the above reasons and the reasons stated in the Amendment and Response mailed on December 9, 2005 the Applicant submits that independent claims 20, 28, and 44 as previously and currently amended are allowable over the prior art of record and that dependent claims 21-27 and 29-43 are allowable as depending from an allowable base claim.

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CONCLUSION

Claims 1-44 are pending in the present application. Claims 1, 20, and 44 have been amended. The Applicant respectfully requests reconsideration of the pending claims in light of the amendments and arguments presented in this Amendment and Response.


If, in the Examiner's opinion, a telephonic interview would expedite prosecution of the present application, the undersigned attorney would welcome the opportunity to discuss any outstanding issues, and to work with the Examiner toward placing the application in condition for allowance.

Respectfully submitted,

Date: January 28, 2006
Reg. No. 40,137

Tel. No.: (781) 271-1503
Fax No.: (781) 271-1527

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Kurt Rauschenbach, Ph.D.
Attorney for Applicant
Rauschenbach Patent Law Group, LLC
Post Office Box 387
Bedford, MA 01730